Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period:\_\_\_\_\_\_\_\_

Endosymbiotic Theory

Part 1: Looking at for similarities

Directions: Below the chart list the similarities between prokaryotes, eukaryotes, mitochondria, and chloroplasts.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Prokaryotes** | **Eukaryotes** | **Mitochondria of  eukaryotic cells** | **Chloroplasts of photosynthetic eukaryotes** |
| **DNA** | 1 single, circular main chromosome, with many copies of smaller circular plasmid DNA | Multiple linear chromosomes compartmentalized in a nucleus | Many copies of small circular  chromosomes | Many copies of small circular chromosomes |
| **Replication** | Binary Fission  (1 cell splits into 2) | Mitosis | Binary Fission (1 cell splits into 2) | Binary Fission (1 cell splits into 2) |
| **Ribosomes \*** | "70 S" | "80 S" | "70 S" | "70 S" |
| **Electron Transport Chain** | Found in the plasma membrane around cell | Not found in the plasma membrane around cell (found only in the cell's mitochondria and chloroplasts) | Found in the plasma membrane around mitochondrion | Found in the plasma membrane around chloroplast |
| **Size (approximate)** | ~1-10 microns | ~50 - 500 microns | ~1-10 microns | ~1-10 microns |
| **Appearance on Earth** | Anaerobic bacteria: ~3.8 Billion years ago Photosynthetic bacteria: ~3.2 Billion years ago Aerobic bacteria:  ~2.5 Billion years ago | ~1.5 billion years ago | ~1.5 billion years ago | ~1.5 billion years ago |
| **Membrane** | Single lipid bilayer plus other (wall, etc) | Single lipid bilayer with embedded proteins | Double lipid bilayer | Double lipid bilayer |
| **Genetic code** | Prokaryotic | Eukaryotic | Prokaryotic | Prokaryotic |

\*The “S” refers to a particular biochemical size/density designation. 70 S is “smaller” or less dense than 80 S.

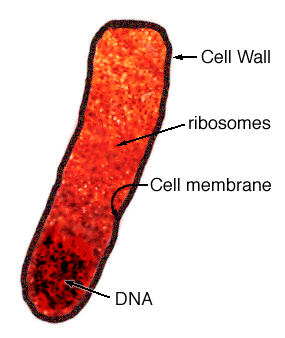
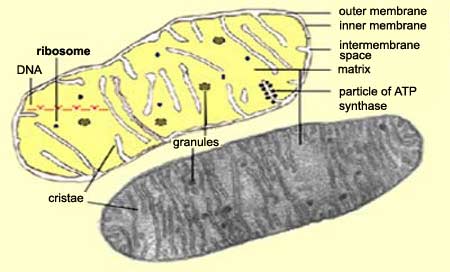
Similarities

* Pro/Mito/Chloro:
  + Euk/Mito/Chloro:
  + Mito/Chloro:

What do the similarities from the chart suggest to you about the origin of mitochondria and chloroplasts?

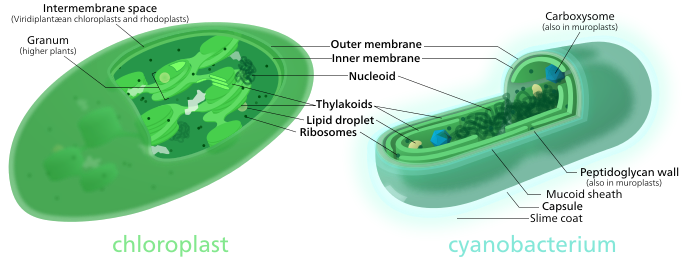
Part 2: Aerobic (oxygen-using) bacteria and mitochondria

Aerobic bacteria Mitochondrion

Name the similarities between aerobic bacteria and mitochondria.

Part 3: Chloroplasts and cyanobacteria





Binary fission of cyanobacteria and chloroplasts. The constriction (arrows) indicates that the cell or chloroplasts is undergoing division. In division of both bacteria and chloroplasts

Name the similarities between chloroplasts and cyanobacteria.

Part 4: Summary - What do the similarities you listed above seem to suggest about mitochondria and chloroplasts?